MOTOROLA INC.
Communications
Group

OPTION C367AU-SP

900 MHZ RECEIVER BOARD

1. ATTACHMENT

-- Model TRF1032A 900 MHz Receiver RF and I-F Board Instruction Section 68P81063E26

2. DESCRIPTION

Option C367AU-SP provides the Model TRF1032A 900 MHz Receiver RF and I-F Board in place of the normally supplied model TRF1011C 800 MHz Receiver RF and I-F Board used with 800 MHz range Spectra-TAC™ voting and satellite receivers. This option can be used with any 800 MHz model *Spectra-TAC* voting and satellite receiver. Refer to attached instruction section 68P81063E26 for further information.

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MICOR SENSITRON RECEIVER RF & I-F BOARD

MODEL TRF1032A
900 MHz

1. INTRODUCTION

This section contains specific theory of operation, maintenance, and troubleshooting information on the receiver rf and i-f deck.

2. RECEIVER RF AND I-F DECK FUNCTIONAL DESCRIPTION

2.1 RF INJECTION STRING

2.1.1 Oscillator (Channel Element)

Channel elements are temperature compensated, crystal controlled oscillators (TCXO), operable over the temperature range of -30° to +60°C (-22° to +140°F). A variable warp capacitor, located in the base of the oscillator, is provided for increased accuracy. Channel elements are factory sealed plug-in modules and should not be field serviced.

2.1.2 Multipliers

The third harmonic of the channel element is selected by a two cell LC tuned circuit. The signal is then multiplied 16 times by two doubler circuits and a double doubler circuit and applied to the two cell preselector of the first mixer.

2.2 RF PRESELECTOR

RF preselector selectivity prevents receiver degradation from mixer image frequency and spurious harmonics. It consists of five low loss, highly selective helical resonant cavities. The bandpass of the preselector is characterized by a flat acceptance bandwidth and a steep skirt response. Carrier signals received at the antenna are routed through the preselector for cavities to the mixer stage to be heterodyned with the injection frequency.

2.3 FIRST MIXER

The first mixer heterodynes the rf signal from the injection string with the carrier signal from the preselector, producing a high i-f of 45 MHz. Frequency relationships are as follows:

$$f_c = 48f_o + 45 \text{ MHz}$$

Where: f_c = carrier frequency
f_o = channel element fundamental

2.4 DOUBLE-POLE CRYSTAL FILTER

The double-pole crystal filter accepts the high i-f of 45 MHz and attenuates signals outside the bandwidth. It increases receiver selectivity and couples the high i-f to the second mixer.

2.5 SECOND MIXER

The second mixer uses a field effect transistor with low noise level and high conversion gain to heterodyne the high i-f with a second oscillator frequency, producing a low i-f of 11.7 MHz. Frequency relationships are expressed as follows:

$$45 \text{ MHz} = f_o + 11.7 \text{ MHz}$$

Where f_o second oscillator frequency

2.6 SECOND OSCILLATOR AND BUFFER

The second oscillator is a crystal controlled, tunable oscillator. It employs a buffer output to prevent load variations from degrading the generated signal and filtering to reduce spurious harmonics.

2.7 FIRST FOUR-POLE CRYSTAL FILTER

This filter and the second four-pole crystal filter are the major factors determining final receiver bandwidth and selectivity.

The first four-pole crystal filter consists of two monolithic crystals and associated impedance matching circuitry. The output of the mixer is coupled to the input of the filter by an adjustable matching network.

Each crystal produces mechanical vibrations at the crystal input when the electrical i-f signal is applied. Due to the inherent piezoelectric property of quartz crystals, these vibrations are propagated throughout the crystal and reconverted to electrical signals at the output electrodes. The high "Q" of the crystals creates a narrow bandpass resulting in excellent off-channel signal rejection.

2.8 FIRST I-F AMPLIFIER

The first i-f amplifier couples signals between the first and second four-pole crystal filters and provides approximately 70 dB gain. The integrated circuit (U601) contains three differential amplifier stages that are internally voltage regulated and temperature compensated. Isolation between the three stages is provided internally.

2.9 SECOND FOUR-POLE CRYSTAL FILTER

The second four-pole crystal filter establishes final receiver selectivity and operates identically to the first four-pole crystal filter previously described. The filter signal is applied to the second i-f amplifier.

2.10 SECOND I-F AMPLIFIER AND LIMITER

The second i-f amplifier and limiter consists of integrated circuit (U602) and with associated discrete components performs amplification and limiting functions.

Four differential amplifiers with internal voltage regulation and temperature compensation are employed. The first two differential amplifiers provide approximately 55 dB gain. The second stage output provides metering and is applied to the third stage. The third stage, along with the fourth stage, becomes overdriven to provide excellent symmetrical limiting characteristics. Full limiting occurs regardless of signal strength.

The limited output of the second i-f amplifier is applied to the discriminator. Since amplitude has now been made constant, the discriminator, which normally would respond to both amplitude and frequency variations produces true frequency demodulation.

3. MAINTENANCE

3.1 INTRODUCTION

This section provides maintenance procedures for the receiver rf and i-f board. These procedures consist of tests which include metering measurements and testing and troubleshooting procedures that includes integrated circuit checks.

NOTE

The receiver rf and i-f board must be installed in a receiver chassis for testing to

NOTE (Cont'd.)

provide the necessary power, ground, control and signal connections. The board should always be secured in place with all mounting screws for operation and testing to provide a good rf ground to all stages of the receiver.

3.2 PERFORMANCE TESTS

3.2.1 General

Use the following tests to determine if the receiver rf and i-f board is operating properly. If testing produces unsatisfactory results, refer to the receiver rf and i-f troubleshooting chart (diagram DEPS-35320).

3.2.2 No-Signal Meter Reading Test

A failure in any part of the rf and i-f board will usually result in improper meter readings at one or more test positions. Perform checks at meter position 1 through 5 and compare the results with values shown in Table 1.

Table 1. Minimum Receiver RF & I-F Meter Readings (No Input Signal Applied)

Selector Switch Position	Reading (Micro-Amps)	Circuit Metered
1	10	Channel Element Output
2	15	First Doubler Output
3	10	Second Doubler Output
4+, 4-	0 ±2	Discriminator Output
5	10	Second I-F Amplifier & Limiter

3.2.2.1 Using the Portable Test Set

Step 1. The receiver rf and i-f board must be installed in a complete receiver chassis for testing. Make sure the rf and i-f circuit board mounting screws are all secure and that all connections to the board are properly made.

Step 2. Be sure the receiver shield is in place.

Step 3. Apply ac input power to the receiver.

Step 4. Using a TEK-37 Adapter Cable, connect a Motorola portable test set or meter panel to the receiver as follows:

- Connect the adapter cable 20-pin connector to the receptacle on the front of the test set or meter panel.

- Connect the adapter cable 7-pin white "metering" plug to the metering receptacle on the receiver rf and i-f board.

Step 5. Set the portable test set switches as follows:

- Set the function switch to the RCVR position.

- Set the meter reversing switch to the OFF position.

- Set the adapter cable SENS switch to the 100 mV position. If the adapter cable has no SENS switch, the unit operates at 100 mV all of the time.

- Set the adapter cable reference switch to position A or position B.

Step 6. Refer to the readings in Table 1. Set the test set selector switch to the positions called for in the table and observe the test set meter. Notice that the meter readings given in the table are minimums.

3.2.2.2 Input Voltages

3.2.2.2.1 If there are no test set indications at one or more of the metered points, check the dc input voltages to the receiver rf and i-f circuit board.

P904-9	A+ continuous (+13.8 V dc with reference to chassis)
P904-11	9.6 V dc continuous (with reference to chassis) (±0.5 V)
P904-8, 6	9.6 V dc continuous (with reference to chassis) (±0.5 V)

3.2.2.2.2 If test set indications localize the trouble to a specific stage or two, measure the dc input voltages to the suspected stages. Refer to the schematic diagram for the normal voltages.

3.2.2.3 Using Built-In Receiver Metering

Step 1. The receiver rf and i-f board must be installed in a complete receiver for testing. Make sure the rf and i-f circuit board mounting screws are all secure and that all connections to the board are properly made.

Step 2. Be sure the receiver shield is in place.

Step 3. Apply ac input power to the station.

Step 4. Plug the receiver service kit into the station.

NOTE

The receiver service kit will not operate unless the TKN6759A Cable Kit has been installed in the receiver.

It is not necessary to turn the metering POWER switch on. The switch should only be in the "on" position when the METER SELECTOR switch is set on position 6.

Step 5. Refer to the meter reading table in paragraph 3.2.2. Set the meter selector switch to the positions called for in the table and observe the meter. Notice that the meter readings given in the table are minimums.

3.2.2.4 20 dB Quieting Sensitivity Test

This performance test may be used after repair and alignment to assure that the receiver meets all specifications before it is returned to service. The receiver shield must be in place while performing this test.

NOTE

If delay line option C770 is used in your station, it msut be bypassed before making a 20 dB quieting measurement. To do this, move the jumpers on the *PURC* control board as listed below.

PURC Board Jumpers	For Delay Line Operation	For 20 dBq Measurement
JU2401D	IN	OUT
JU2401E	OUT	IN
JU2401F	IN	OUT

- Using an AC Voltmeter and Portable Test Set

Step 1. Perform Steps 1 thru 5 in paragraph 3.2.2.1.

Step 2. Connect an ac voltmeter across pins 1 and 18 of the audio control module.

Step 3. (PL receivers only.) Disable PL, using the switch on the PL module.

Step 4. Set the receiver squelch control fully counterclockwise (unsquelched).

Step 5. Adjust the LINE LEVEL control so the ac voltmeter reads 565 mV ac.

Step 6. Set the signal generator controls as follows:

- Set up the signal generator to produce a cw or unmodulated signal.

- Set the generator output level to maximum.

- Set the signal generator output frequency to the selected channel receive frequency. To set the signal generator on frequency without a frequency counter, adjust the generator frequency control until test set meter position 4 reads exactly zero.

Step 7. Slowly decrease the signal generator output level until the ac voltmeter reads 56.5 mV ac (20 dB down from 565 mV ac). Switch to a lower voltmeter scale if necessary.

NOTE

The output frequency of some signal generators will be "pulled" when the output level is near maximum. It may be necessary to reset the generator frequency to zero meter 4 as the output level is reduced.

Step 8. Note the signal generator output level. If the receiver rf and i-f board is functioning properly, this level should be 1.5 uV or less.

Step 9. Readjust the LINE LEVEL control as described in the Maintenance section of the manual.

3.2.2.5 Using Built-In Receiver Metering

Step 1. The receiver rf and i-f board must be installed in a complete receiver for testing. Make sure the rf and i-f circuit board mounting screws are all secure and that all connections to the board are properly made.

Step 2. Be sure the receiver shield is in place.

Step 3. Apply ac input power to the receiver. Turn metering on.

Step 4. Unsquelch the receiver by turning the SQUELCH control fully counterclockwise. *PrivateLine* stations must also be PL disabled.

Step 5. Set meter selector switch to POS 6 and the speaker switch to the "off" POS. Adjust the LINE LEVEL control for 50 uA as indicated on the meter.

Step 6. Connect an rf signal generator to the receiver input connector.

Step 7. Set the signal generator controls as follows:

- Set up the signal generator to produce a cw or unmodulated signal.
- Set the generator output level to maximum.
- Set the signal generator output frequency to the selected channel receive frequency. To set the signal generator on frequency without a frequency counter, adjust the generator frequency control until meter position 4 reads exactly zero.

Step 8. Slowly decrease the signal generator output level until METER POS 6 reads 5 uA.

NOTE
The output frequency of some signal generators will be "pulled" when the output level is near maximum. It may be necessary to reset the generator frequency to zero meter 4 as the output level is reduced.

Step 9. Note the signal generator output level. If the receiver rf and i-f board is functioning properly, this level should be 0.5 uV or less.

Step 10. Readjust the LINE LEVEL control as described in the Maintenance section of the manual.

3.3 FIRST MIXER REPLACEMENT PROCEDURE

3.3.1 General

3.3.1.1 Extreme care must be exercised in removing the mixer substrate. It is recommended that complete troubleshooting be performed to assure that the mixer is faulty before attempting replacement. No attempt should be made to repair individual substrate components, Rather, *the mixer should be replaced as an assembly*.

3.3.1.2 Two types of soldering irons are required to remove and replace the mixer. A chisel tipped iron of 150 watt rating is needed for connections to the rf deck. A small iron of 50 watt rating is required for substrate connections.

3.3.2 Replacement Procedure

Step 1. Remove the receiver rf and i-f board from the chassis.

Step 2. Unplug the mixer output cable from the rf and i-f board and remove the screws holding the cable lugs to the rf deck.

Step 3. Remove the four hex-Phillips screws which hold the mixer cavity shield.

Step 4. Using the large iron, unsolder the ground straps from the rf deck, adding solder as necessary to insure proper heat transfer.

Step 5. Carefully unsolder the two heavy gauge wire connections leading to pads at the top edge of the mixer substrate.

CAUTION
Prolonged heat or excessive strain at these connections may result in permanent damage to the substrate and associated components.

When both leads are free, bend the leads slightly to facilitate easy removal of the substrate.

Step 6. Lift the substrate VERTICALLY out of the rf deck.

Step 7. Press the nylon guides onto the edges of the replacement mixer substrate and carefully slide the unit into the rf deck.

Step 8. Using a large, well tinned iron, solder the ground straps to the rf deck. Remove excess solder to allow the cover to fit flush over the mixer cavity.

Step 9. Bend the heavy leads to conform to the pads on the substrate. The leads must be formed so that no strain is placed on the substrate when the leads are soldered in place. Use the minimum heat necessary to insure a good solder connection.

Step 10. Replace mixer cavity cover.

3.4 DOUBLE DOUBLER REPLACEMENT PROCEDURES

3.4.1 Assembly Replacement Procedure

Step 1. Disconnect the input coaxial cable (phono connector to printed circuit board) and the output cable (coaxial cable from the injection filter).

Step 2. Disconnect the 9.6 volt supply line (orange) at the printed circuit board.

Step 3. Remove the screws which fasten the input coaxial cable to the rf deck.

Step 4. Remove the three screws which fasten the quadrupler housing to the rf deck.

Step 5. Replace the new double doubler assembly in the reverse order of the above procedure.

3.4.2 Transistor Replacement Procedure

Using a 50 watt soldering iron and silver solder (silver content 2§), perform transistor replacement as follows.

Step 1. Carefully unsolder L201, L203, and R201 at the transistor pads and bend the components away from the transistor.

Step 2. Unsolder and remove the transistor.

Step 3. Remove excess solder from the substrate solder pads.

Step 4. Place the new transistor on the substrate pads. While holding the transistor in place with a tweezers, solder the emitter lead first and then the remaining leads. Be sure the transistor leads are positioned in the center of their respective substrate pads.

Step 5. Reposition L201, L203, and R201 and resolder their leads.

Step 6. Perform double doubler testing to insure unit is properly functioning.

3.5 TROUBLESHOOTING

3.5.1 Visual Inspection

3.5.1.1 The first step in the troubleshooting procedure should be a thorough visual inspection of the receiver and, in particular, the receiver rf and i-f board. Corrosion and burned or damaged components are usually easily seen and may be the cause of a symptom of the receiver malfunction. Loose circuit board mounting screws or a loose or improperly installed receiver shield are other easily found problems that can cause a considerable degradation in receiver performance.

3.5.1.2 After the obvious problems have been corrected, repeat the receiver rf and i-f board performance tests. If the tests still produce unsatisfactory results, refer to the receiver rf and i-f troubleshooting chart. The troubleshooting chart provides a systematic procedure for isolation of the defective stage and component.

3.5.1.3 As much information as possible has been included on the troubleshooting chart. However, you may have to refer occasionally to the receiver rf and i-f schematic diagram and circuit board detail. Detailed procedures regarding integrated circuits, troubleshooting, receiver gain measurements, and crystal dip tests follow in the text of this section of the manual.

3.5.2 Alignment as a Troubleshooting Technique

Low test set readings, improper discriminator output, and otherwise abnormal performance are very often corrected by realignment. Therefore, alignment should be one of the first troubleshooting steps performed for these symptoms.

3.5.3 Troubleshooting Integrated Circuits

3.5.3.1 Integrated circuits (ICs) are very reliable components and should not be replaced unless it is definitely indicated that the IC is the defective component. Before replacing an IC, make sure that the external components in the circuit are normal.

3.5.3.2 The ICs on the receiver rf and i-f board may be checked by dc voltage measurements. Proper voltages are shown in Table 2.

3.5.4 Receiver Gain Measurements

A defective crystal in the i-f selectivity portion of the receiver can be located by measuring receiver gain voltages and performing crystal dip tests.

NOTE

Before making any receiver gain measurements, make sure the case of every filter crystal has a good conductive path to

Table 2.
Nominal Receiver Integrated Circuit DC Voltages
(All readings are in volts dc,
measured with respect to chassis)

Pin No.	U601 Voltage	U602 Voltage
1	GND	2.8
2	GND	GND
3	2.9	2.9
4	6.6	6.6
5	9.3	9.3
6	7.2	7.2
7	6.4	6.4
8	2.9	2.9
9	2.9	2.9
10	GND	GND

NOTE: All voltages may vary ±10% from nominal readings shown.

NOTE (Cont'd.)

ground. An ohmmeter test should indicate less than 1 ohm between the crystal case and the receiver circuit board ground plating. A bad ground connection may cause errors in gain measurements.

Step 1. Proper receiver alignment is essential to this procedure. Complete receiver rf and i-f alignment. Leave alignment test equipment connected to perform this check.

Step 2. Refer to receiver gain measurements in Table 3, the rf and i-f schematic diagram, and the rf and i-f circuit board detail.

NOTE

Receiver rf input voltages given in Table 3 are those at the receiver input connector. If a pad or other attenuator is connected between the signal generator and the receiver rf input, the signal generator output control must be set to compensate for the loss in the pad.

Examples:

6 dB loss means V out of the pad = 1/2 V into the pad.

20 dB loss means V out of the pad = 1/10 V into the pad.

Step 3. Set the signal generator output frequency to the receiver channel frequency ("0" reading on meter 4). Adjust the signal generator output to provide the required receiver input voltage for a particular test point as listed in the table. Then, using an rf voltmeter, measure the rf signal voltage between the test point and a nearby chassis ground point. When using a high impedance rf probe (see Table of Recommended Test Equipment), the measured voltage at every test point should be within ±6 dB of the value given in Table 3.

Table 3. Receiver Gain Measurements

Test Point (see rf & i-f circuit board detail)	Receiver Input Voltage (preset)	Test Point Voltage (mV) ±6 dB	Remarks
L	50 mV	180	
M	50 mV	250	
N	50 mV	600	
O	50 mV	575	
P	50 mV	550	
Q	50 mV	500	
R	50 mV	250	U601
S	50 mV	800	saturated
T	20 uV	400	output
U	20 uV	375	
V	20 uV	350	
W	20 uV	300	U602
X	20 uV	75	saturated
Y	0	1000	output

Step 4. A high or low test point voltage measurement *may* indicate that the crystal at or ahead of the test point is defective. However, it may also indicate that an associated circuit component is defective. The extremely high-Q crystals used in *Micor* radios are very sensitive to associated circuit components. For example, if L601 is defective, it might appear that Y601 is bad. To isolate the defective component, perform the crystal dip tests described in the following procedure.

3.5.5 Crystal Dip Test

3.5.5.1 A defective crystal in the i-f selectivity portion of the receiver can be located by measuring receiver gain voltages and performing crystal dip tests.

3.5.5.2 The monolithic crystals used in *Micor* receivers are made up of two separate resonators on a single quartz blank. Each crystal has a pair of characteristic operating frequencies. One way to find the characteristic frequencies of each crystal is to short the crystal output to chassis ground, then monitor the crystal input voltage with an rf voltmeter while varying the signal generator frequency across the bandpass of the receiver. Low voltage points will occur at each of the crystal characteristic frequencies.

3.5.5.3 Figures 1 and 2 are plots of typical rf voltmeter readings obtained while testing good crystals. Note that the horizontal scales are calibrated in frequency, with f_o the channel frequency of the receiver. The vertical scales represent *relative* rf voltmeter readings. The bottom line is zero and the top line is maximum. Notice that each plot has a sharp minimum point above f_o and another below f_o. The table of crystal dip frequencies at the end of this section lists the frequencies at which these dip points should appear. If the measured dips fall outside the tolerances listed in the table, the crystal *may* be defective.

Step 1. Leave the test equipment set up as was done for the receiver gain measurements.

Step 2. Set the signal generator to f_o, the receiver channel frequency ("0" on meter 4). Adjust the generator output control for at least 50 mV *at the receiver input connector*.

Step 3. Refer to the crystal dip frequencies in Table 4. To test a particular crystal, find it in the table, ground the indicated test point, and connect an rf voltmeter between the monitored test point and a nearby chassis ground point.

Step 4. Starting at f_o, slowly increase the signal generator frequency while watching for a dip in the rf voltmeter reading. This dip should be sharp, so increase the signal generator frequency very slowly and watch the rf voltmeter closely. When the dip is found, write down the frequency counter reading.

Step 5. Return the signal generator to f_o. Then watch the rf voltmeter while *slowly decreasing* the signal generator frequency. When the dip is found, write down the frequency counter reading.

Step 6. Compare your test results with the frequencies and tolerances listed in the table for the crystal you have tested. If the measured dips fall outside the tolerances listed in the table, the crystal *may* be defective. Continue with this procedure to isolate the bad component.

Step 7. FOR TEST PURPOSES ONLY, exchange the suspected crystal with another from the receiver. Be sure you note the polarity of the crystal when you make the change. Repeat the receiver gain measurement and crystal dip test on the suspected crystal in the new location. If the suspected crystal tests bad again, consider it defective and replace it. If the crystal tests good, look for defective associated components at the original crystal location.

Step 8. When the tests are completed, be sure *all* jumpers connected during the test are removed and that any *moved crystals are returned to their original locations*. Refer to the parts list and circuit board detail for correct part location. Note crystal polarity when replacing crystals.

Table 4. Crystal Dip Frequencies

Crystal	Test Point Grounded	Test Point Monitored	+ Frequency Dip (kHz) ±2.5 kHz	— Frequency Dip (kHz) ±2.5 kHz
Y601	O	N	4.5	9.0
Y602	Q	P	4.0	10.0
Y603	U	T	4.5	9.0
Y604	W	V	4.0	10.0

3.5.6 Double Doubler Troubleshooting

Disconnect the input coaxial cable (phono connector to printed circuit board). Test the second doubler output. If the second doubler is operating properly, reconnect the double doubler input coaxial cable to the 2nd doubler. Disconnect the double doubler output cable. Using a 50 ohm probe, rated for at least 1000 MHz, test the double doubler output voltage. A minimum reading of 70.7 millivolts should be obtained. If the minimum reading is not obtained, check the dc voltages on the schematic.

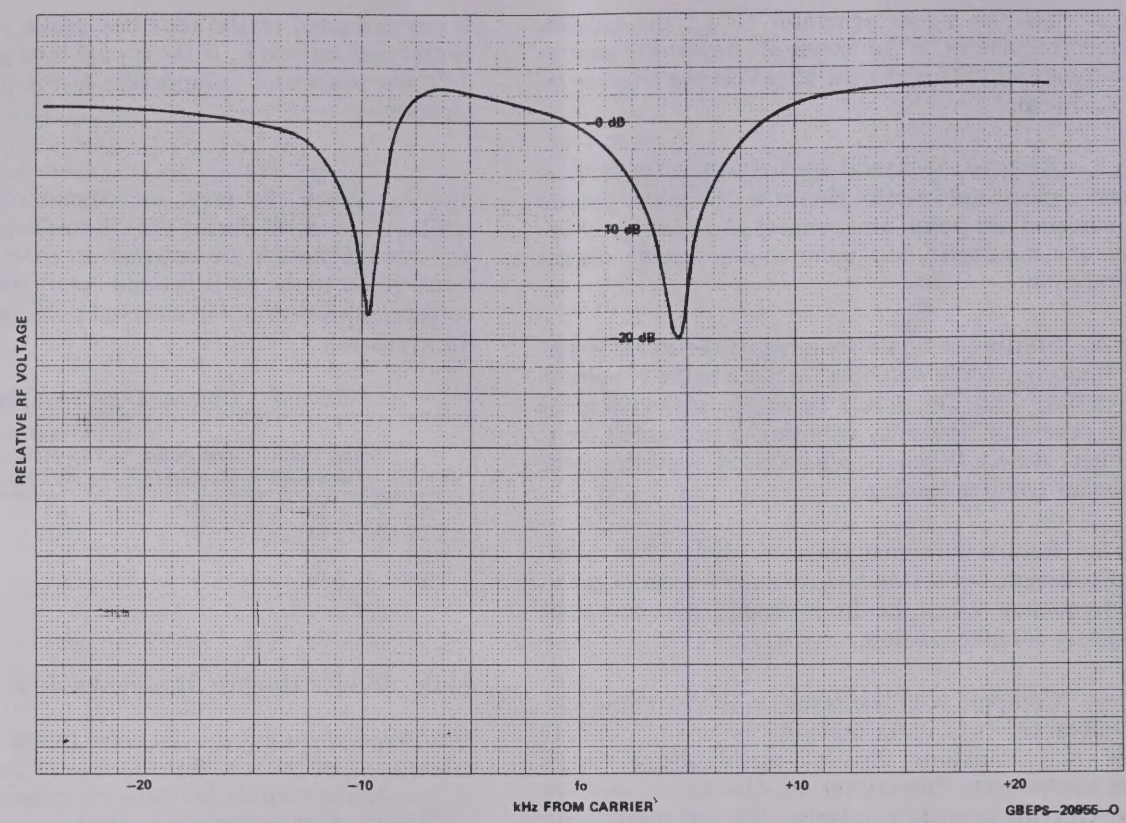


Figure 1. Typical Plot of a Known Good Crystal in Position Y601 or Y603

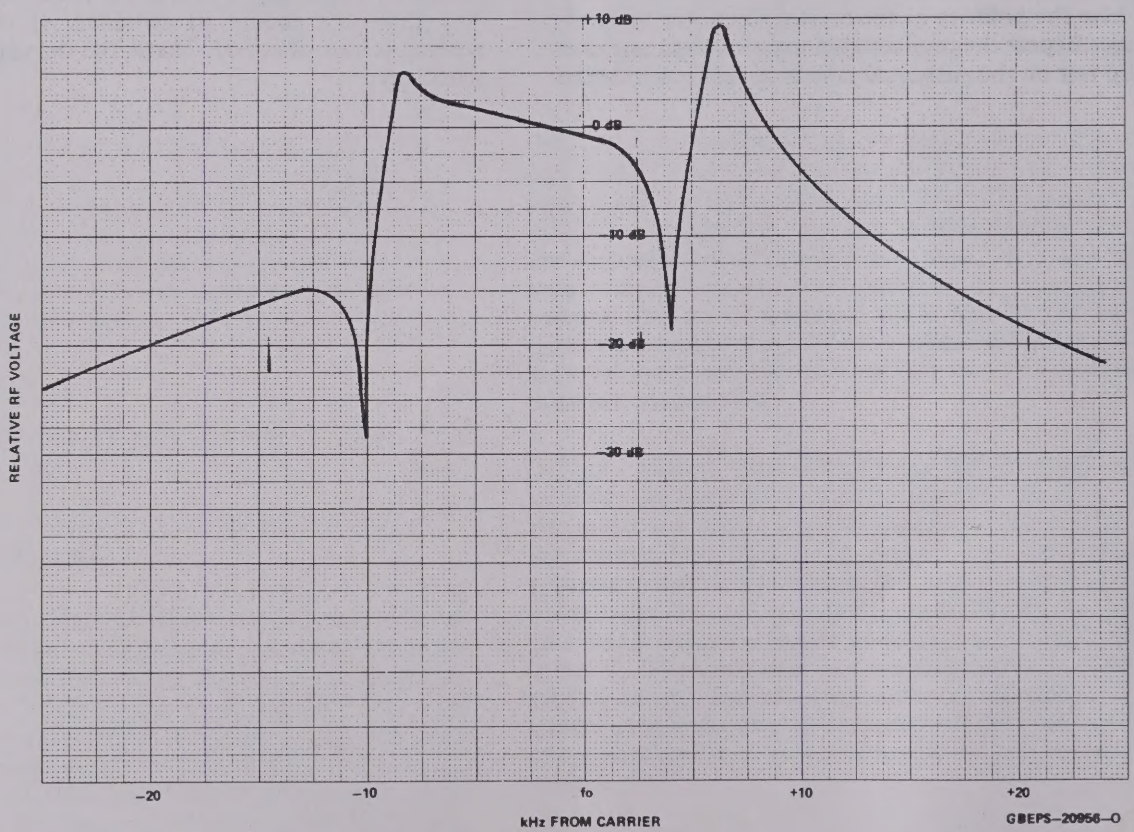


Figure 2. Typical Dip Plot of a Known Good Crystal in Position Y602 or Y604

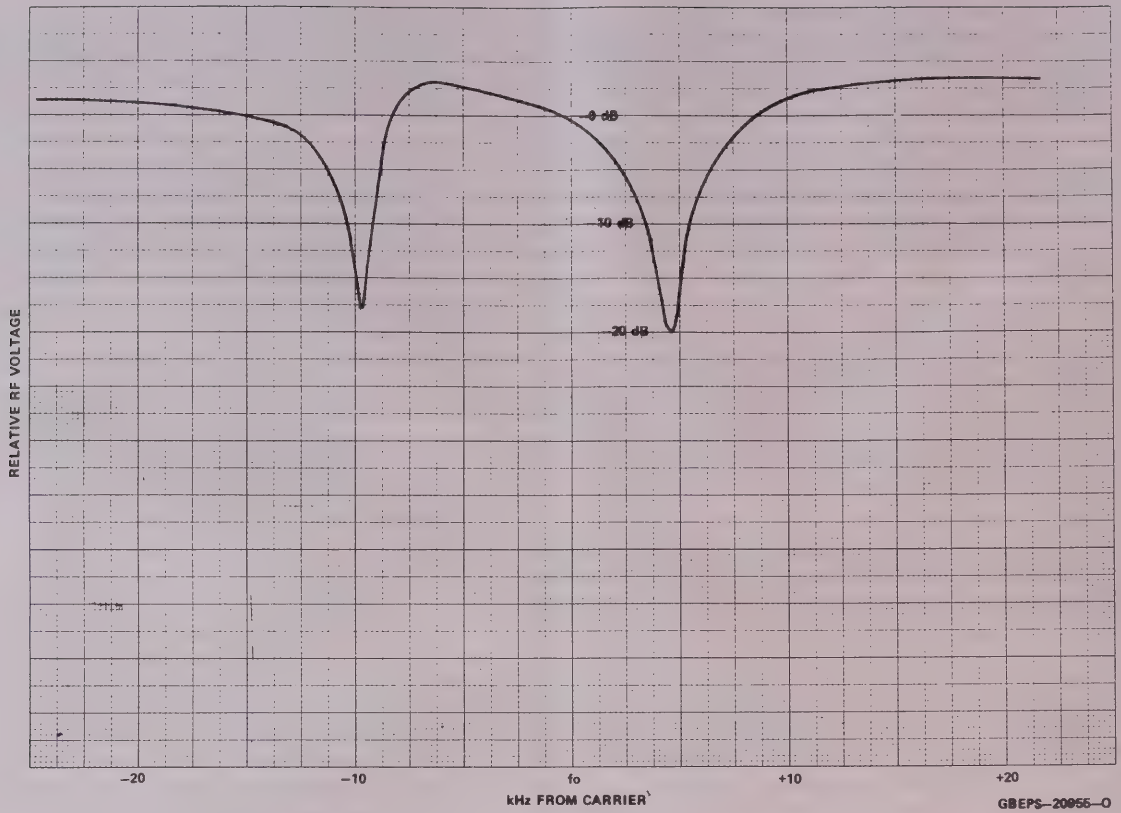


Figure 1. Typical Plot of a Known Good Crystal in Position Y601 or Y603

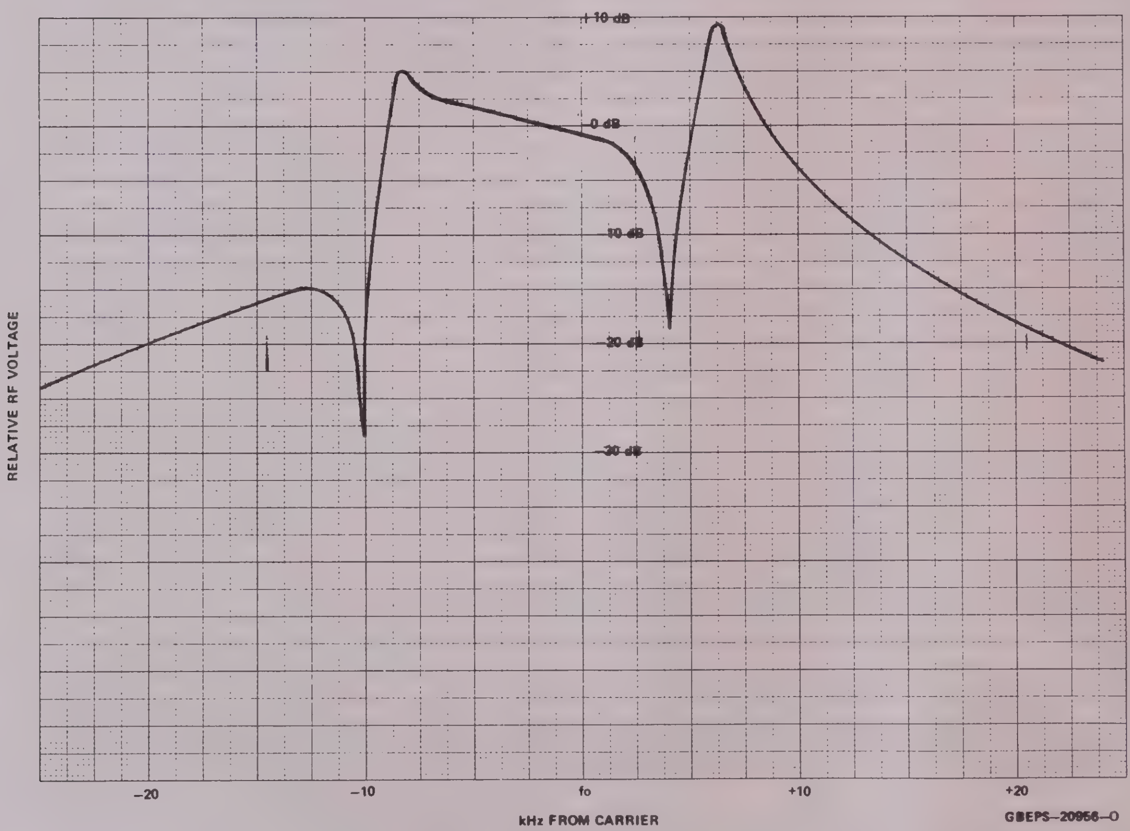
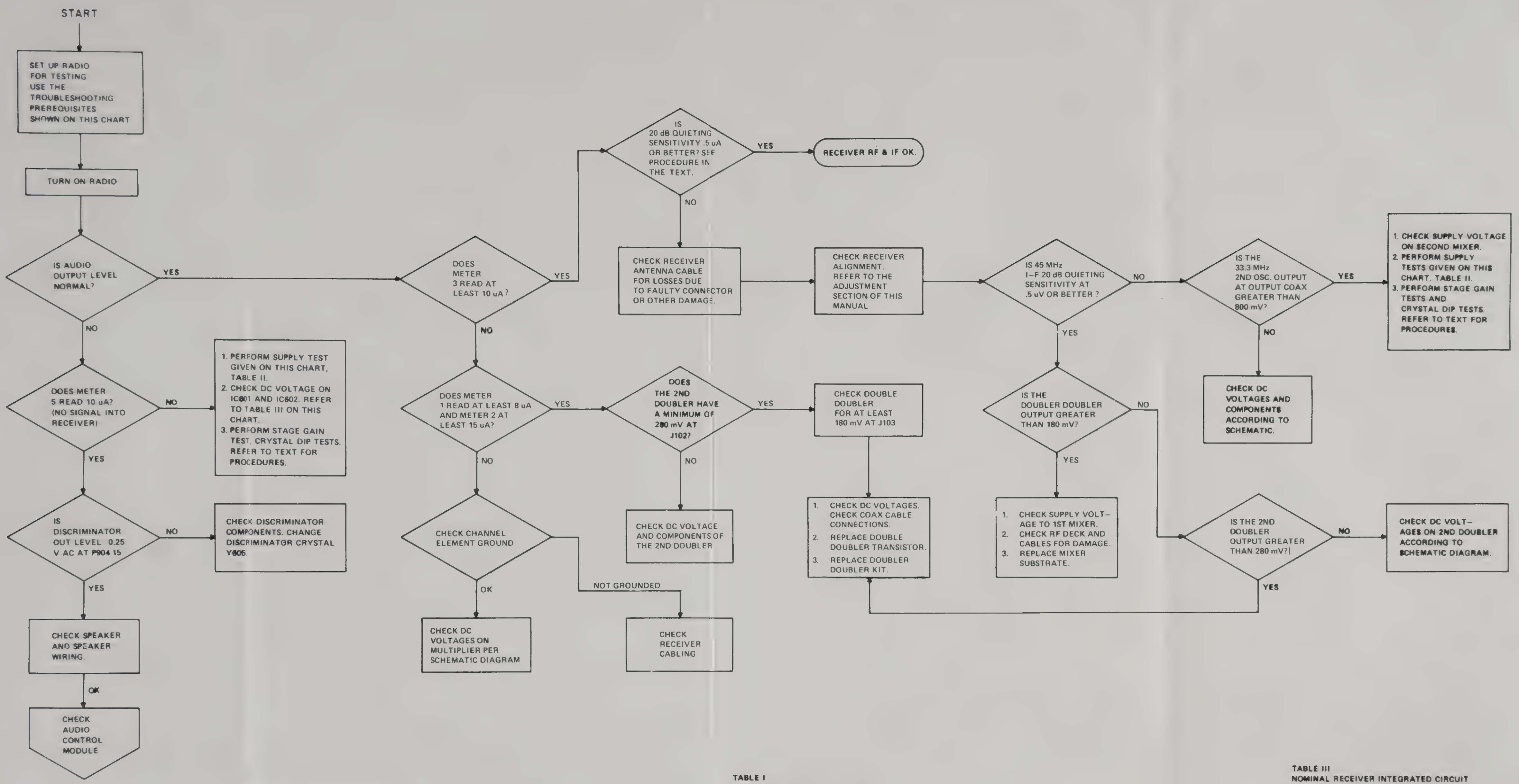


Figure 2. Typical Dip Plot of a Known Good Crystal in Position Y602 or Y604



TROUBLESHOOTING PREREQUISITES

1. THE RECEIVER RF & IF BOARD MUST BE INSTALLED IN A COMPLETE RECEIVER FOR TESTING. BE SURE ALL CIRCUIT BOARD MOUNTING SCREWS ARE SECURE, SHIELDS INSTALLED, AND THAT ALL CONNECTIONS TO THE BOARD ARE PROPERLY MADE.
2. USING A TEK–37 ADAPTER CABLE, CONNECT A MOTOROLA PORTABLE TEST SET OR METER PANEL TO THE RADIO AS FOLLOWS:
   - A. CONNECT THE ADAPTER CABLE 20–PIN CONNECTOR TO THE RECEPTACLE ON THE FRONT OF THE TEST SET OR METER PANEL.
   - B. CONNECT THE WHITE "METERING" PLUG TO THE METERING RECEPTACLE ON THE RECEIVER RF AND IF BOARD.
3. SET PORTABLE TEST SET SWITCHES AS FOLLOWS:
   - A. FUNCTION SWITCH TO THE RCVR POSITION.
   - B. METER REVERSING SWITCH TO OFF POSITION.
   - C. ADAPTER CABLE SENS SWITCH TO THE 100 mV POSITION. IF THE ADAPTER CABLE HAS NO SENS SWITCH, THE UNIT OPERATES AT 100 mV ALL OF THE TIME.
   - D. ADAPTER CABLE REFERENCE SWITCH TO POSITION A OR B.
   - E. D. SELECTOR SWITCH AS REQUIRED BY THE TROUBLESHOOTING PROCEDURE.
4. ON "PRIVATE–LINE" RADIOS, DISABLE THE PL MODULE.
5. SET THE SQUELCH CONTROL FULLY COUNTERCLOCKWISE (UNSQUELCHED).
6. SET THE VOLUME CONTROL FOR A COMFORTABLE LISTENING LEVEL.
7. HIGH RF FREQUENCY MEASUREMENTS SHOULD BE MADE WITH AN ACCURATE METER SUCH AS THE MOTOROLA S1339A (SEE EQUIPMENT LIST).

TABLE I
MINIMUM RECEIVER RF & IF METER READINGS TABLE
(NO INPUT SIGNAL APPLIED)

SELECTOR SWITCH POSITION	READING (MICRO–AMPS)	CIRCUIT METERED
1	8	CHANNEL ELEMENT OUTPUT
2	15	FIRST DOUBLER OUTPUT
3	10	SECOND DOUBLER OUTPUT
4	0 ± 2	DISCRIMINATOR OUTPUT
5	10	SECOND I–F AMPLIFIER AND LIMITER

TABLE II
RECEIVER RF & IF DC INPUT VOLTAGES

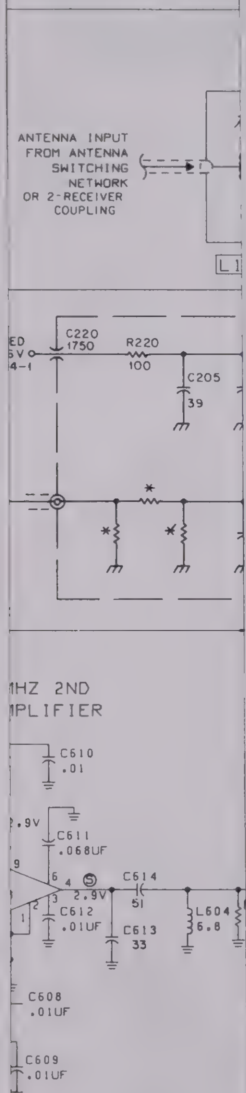
TEST POINT	DESCRIPTION
P904–9	B+ CONTINUOUS (+13.8 V DC WITH REFERENCE TO CHASSIS)
P904–11	9.6 V DC CONTINUOUS (WITH REFERENCE TO CHASSIS) (±0.5 V)
P904–8,6	9.6 V DC CONTINUOUS (WITH REFERENCE TO CHASSIS) (±0.5 V)

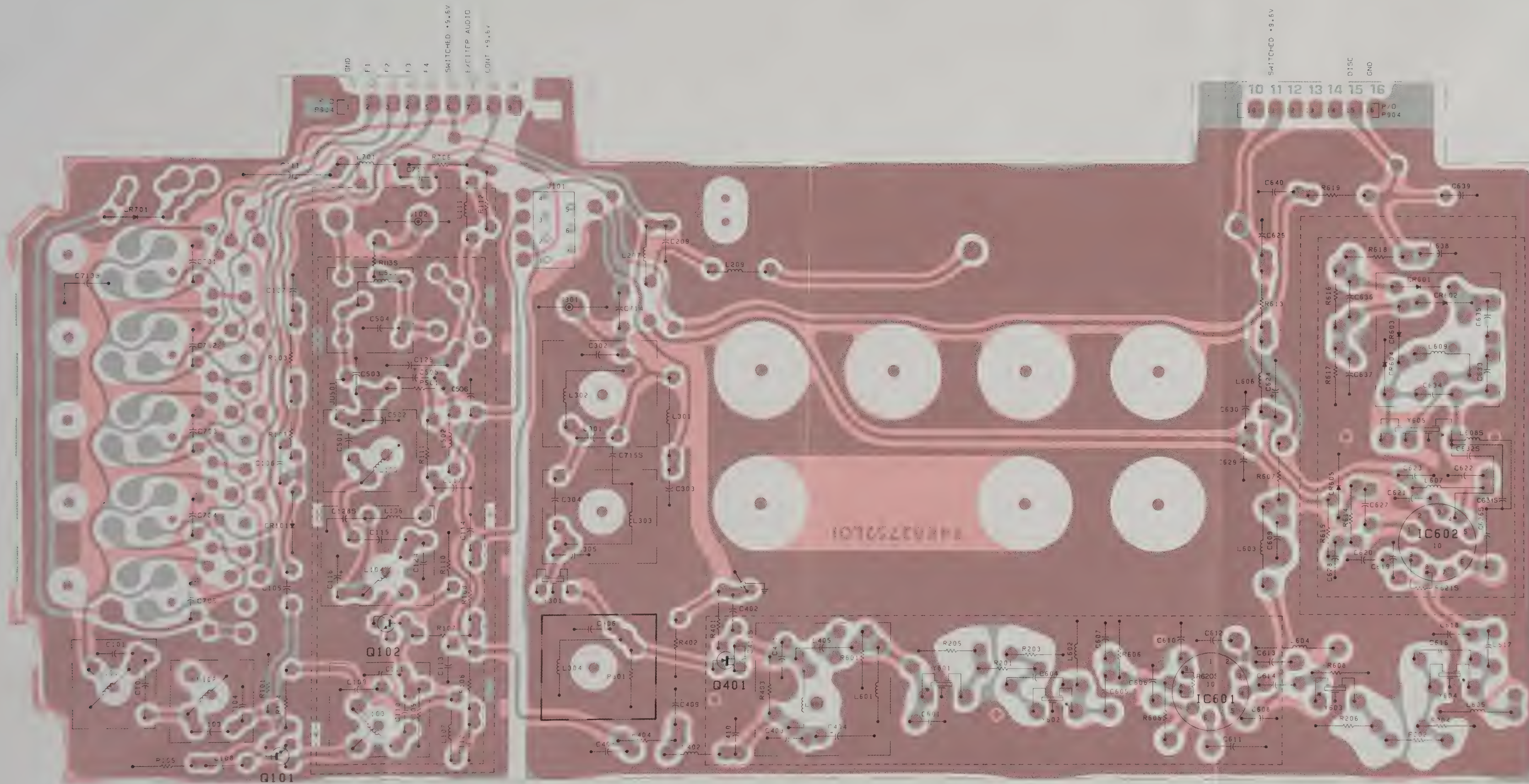
TABLE III
NOMINAL RECEIVER INTEGRATED CIRCUIT DC VOLTAGES
(ALL READINGS ARE IN VOLTS DC, MEASURED WITH RESPECT TO CHASSIS)

PIN NO.	U601 VOLTAGE	U602 VOLTAGE
1	GND	2.8
2	GND	GND
3	2.8	2.8
4	6.6	6.6
5	9.3	9.3
6	7.2	7.2
7	6.4	6.4
8	2.8	2.8
9	2.8	2.8
10	GND	GND

NOTE: ALL VOLTAGES MAY VARY ±10% FROM NOMINAL READINGS SHOWN.

DEPS– 35320–0


ANTENNA INPUT
FROM ANTENNA
SWITCHING
NETWORK
OR 2-RECEIVER
COUPLING
C220
1750
R220
100
C205
39
MHZ 2ND
MPLIFIER
C610
.01
C611
.068UF
C614
51
2.9V
C612
.01UF
C613
33
L604
6.8
C608
.01UF
C609
.01UF

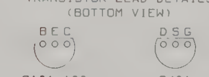


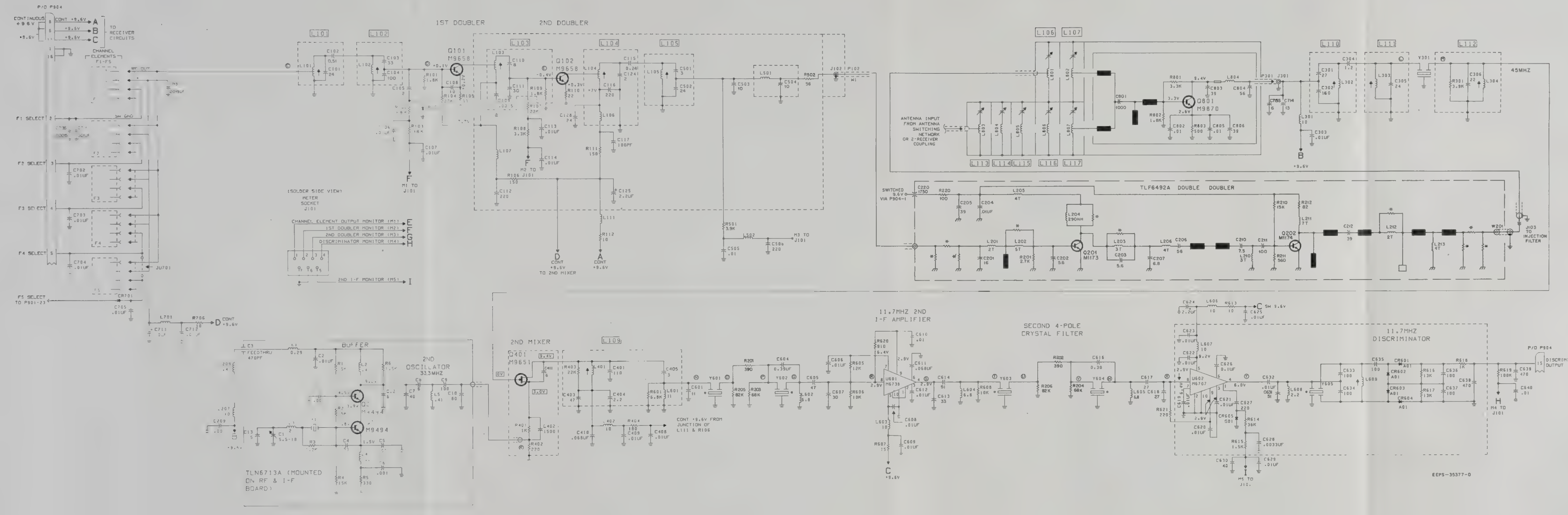
—— —— SHIELD ON COMPONENT SIDE
– – – – – – SHIELD ON SOLDER SIDE
PARTS ENDING IN 'S' ARE ON SOLDER SIDE
* INDICATES CRYSTAL POLARITY

COMPONENT SIDE BD-EEPS-24370-O
SOLDER SIDE BD-EEPS-24371-O
OL-EEPS-24372-A

SHOWN FROM SOLDER SIDE

TRANSISTOR LEAD DETAILS
(BOTTOM VIEW)





RECEIVER RF & I-F NOTES

101 FREQUENCY CALCULATION

$f_C = 48f_O + 45\ MHZ$

$f_O = \frac{f_C - 45\ MHZ}{48}$

WHERE f_C = CARRIER FREQUENCY
f_O = CHANNEL ELEMENT FREQUENCY
45 MHZ = 1ST MIXER OUTPUT FREQUENCY (HI I-F)
48 = CHANNEL ELEMENT HARMONIC
11.7 MHZ = 2ND MIXER OUTPUT FREQUENCY (LO I-F)

102 DASHED LINES REPRESENT SHIELDING

103 INDEX DOT ON CRYSTAL CAN INDICATES PHYSICAL ORIENTATION REQUIRED

104 UNLESS OTHERWISE STATED CAPACITOR VALUES ARE IN PICOFARADS RESISTOR VALUES ARE IN OHMS

105 FOR ACCURATE MEASUREMENT RF VOLTAGES TAKEN WITH MOTOROLA RF MILLIVOLTMETER AND RF PROBE QUADRUPLIER OUTPUT WITH 50 OHM BNC TIP PROBE

106 UNLESS OTHERWISE STATED VOLTAGE MEASUREMENTS ARE FOR DC VOLTAGES MEASURED WITH AN 11 MEGOHM INPUT RESISTANCE VOLTMETER IN RESPECT TO CHASSIS GROUND

107 DC VOLTAGE IS FUNCTION OF SIGNAL LEVEL

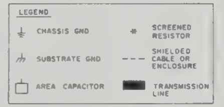
108 THE TWO-RECEIVER COUPLER MOUNTS IN THE RECEIVER SECTION OF THE UNIFIED CHASSIS THE COUPLER CONNECTS BETWEEN THE ANTENNA SWITCH AND BOTH RECEIVERS

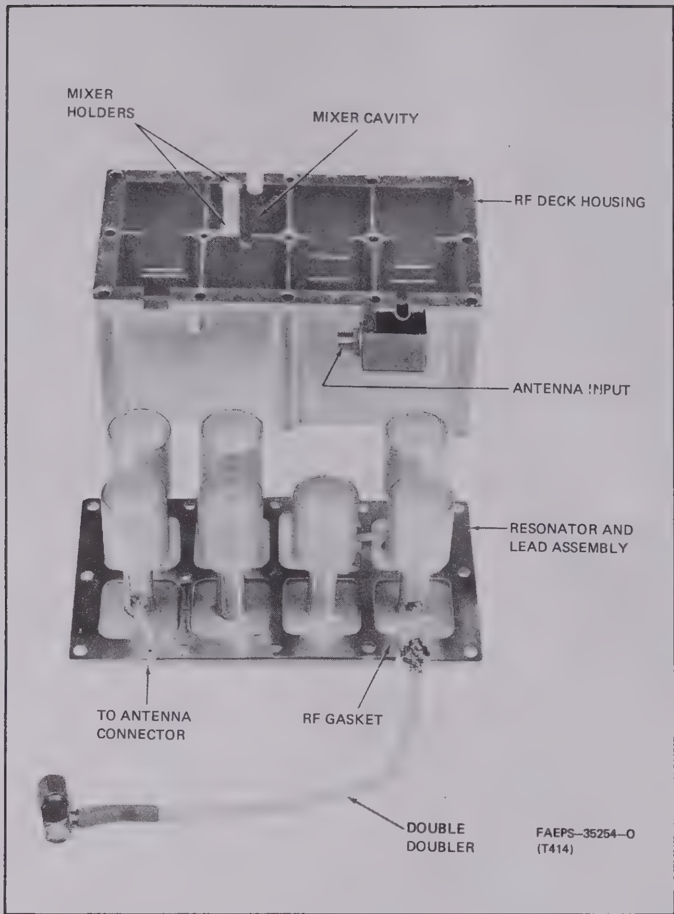
109 THE 2 RECEIVER COUPLER IS USED IN BASE STATION APPLICATIONS ONLY

TABLE III
NOMINAL RECEIVER INTEGRATED CIRCUIT DC VOLTAGES (ALL READINGS ARE IN VOLTS DC MEASURED WITH RESPECT TO CHASSIS

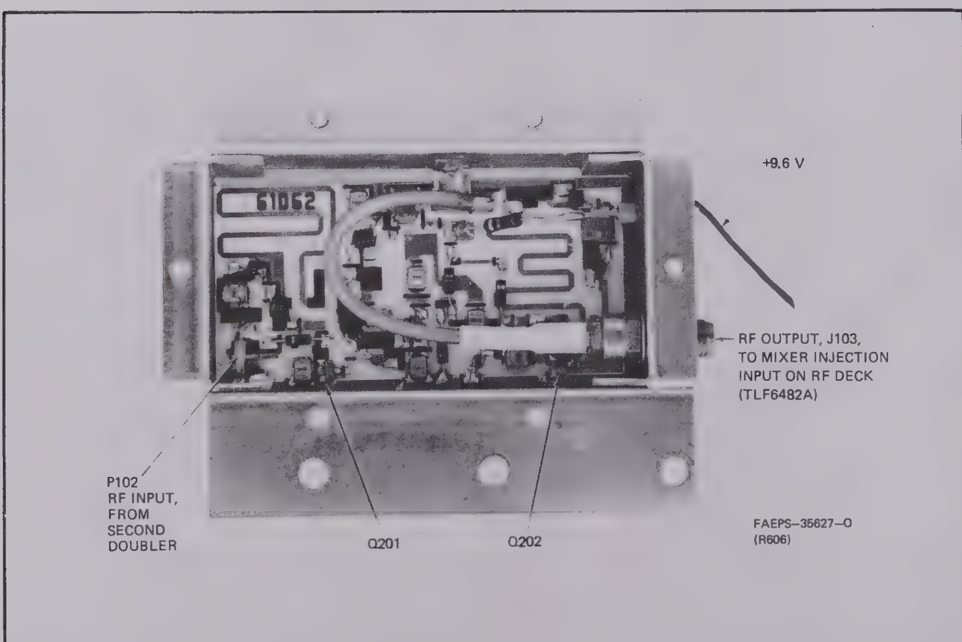
PIN NO	U601 VOLTAGE	U602 VOLTAGE
1	GND	2.8
2	GND	GND
3	2.8	2.8
4	6.6	6.6
5	9.3	9.3
6	7.2	7.2
7	6.4	6.4
8	2.8	2.8
9	2.8	2.8
10	GND	GND

NOTE ALL VOLTAGES MAY VARY FROM NOMINAL READINGS SHOWN





RF DECK



DOUBLE DOUBLER

CHARACTERISTICS

ıtains receiver frequency within ±0.0002% of reference frequency from -30°C mperature (+25°C reference).
eshold

parts list

TRF6112C Receiver RF and I-F Board PL-8215-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: pF ± 5%; 500 V: unless otherwise stated
C101	21-82133G74	24; N150
C102	21-82450B29	0.51
C103	21-84493B44	33
C104	21-82610C44	100
C105	21-857336	2 ± .2
C106, 107	21-82428B59	.01 uF + 80-20%; 200 V
C108	21-82355B26	10 ± .25
C109	21-82187B11	.0015 uF ± 10%; 100 V
C110	21-838912	8 ± .25
C111	21-82610C14	30
C112	21-82187B08	220 ± 10%
C113, 114	21-82428B59	.01 uF + 80%20%; 200 V
C115	21-82450B35	0.2 ± 10%
C116	21-82187B08	220 ± 10%
C117	21-831125	100 ± 10%; 300 V
C124	21-857336	2
C125	23-84762H04	2.2 uF ± 20%
C128	21-840365	24
C209	21-82187B20	1000 ± 10%; 100 V
C301	21-83406D37	27
C302	21-84534B05	160
C303	21-82428B59	.01 uF + 80-20%; 200 V
C304	21-82450B08	1.2
C305	21-82133G46	24
C306	21-82133G62	22
C401	21-82610C69	110, 200 V
C402	21-82187B31	1500 ± 10%; 200 V
C403	21-82610C03	47; 200 V
C404	23-84762H04	2.2 uF ± 20%; 25 V
C405	21-82450B11	3; 500 V
C408, 409	21-82428B59	.01 uF + 80-20%; 200 V
C410	8-82905G04	.068 uF ± 10%; 50 V
C411	21-840848	6 pF ± .5 pF
C501	21-82610C94	3 ± .1
C502	21-840365	24
C503, C504	21-83406D89	10
C505	21-82428B59	.01
C506	21-82187B08	220
C601	21-851845	11; NP0
C604	21-82450B07	0.39
C605	21-83406D44	47 ± 0.5%; N080
C606	21-82426B59	.01 uF + 80-20%; 200 V
C607	21-82610C14	30 pF ± .5 pF; N150
C608	21-82428B59	.01 uF + 80-20%; 200 V
C609, 610	21-82428B59	.01 uF + 80-20%; 200 V
C611	8-83813H05	.068 uF ± 10%; 100 V
C612	21-82428B59	.01 uF ± 10%; 200 V
C613	21-82355B09	33 ± 0.5%; NP0
C614	21-82610C29	51 ± 0.5%; N150
C616	21-82450B01	0.30 ± 0.5%
C617, 618	21-83406D37	27 ± 0.5%; N150
C619, 620	21-82428B59	.01 uF + 80-20%; 200 V
C621, 622, 623, 624	23-84762H04	2.2 uF ± 20%; 25 V
C625	21-82428B59	.01 uF + 80-20%; 200 V
C626	8-83813H06	.10 uF ± 10%; 100 V
C627	21-82187B08	220
C628	21-82428B57	.0033 uF ± 10%; 200 V
C629	21-82428B59	.01 uF + 80-20%; 200 V
C630	21-84493B24	40
C631	21-82610C07	51; 200 V
C632	21-861443	.01 uF + 100-20%; 75 V
C633, 634, 635, 636, 637	21-83798B01	100; 200 V
C638, 639	21-82187B39	470 ± 10%
C640	21-82428B59	.01 uF + 80-20%; 200 V
C701 thru 705	21-82428B59	.01 uF + 80-20%; 200 V
C711	23-84762H03	10 uF ± 10%; 20 V
C712	21-82428B59	.01 uF + 80-20%; 200 V
C713	21-82187B11	.0015 uF ± 10%; 100 V
C714	21-00865054	13; N330
C715	21-840848	6 pF ± 0.5 pF
		diode: (see note)
CR101	48-82139G01	germanium
CR601 thru 604	48-84616A01	hot carrier
CR605	48-82139G01	germanium
CR701	48-82392B03	silicon
		connector, receptacle:
J101	9-84207B01	female; 7 contact
J102, J301	9-84231B02	female; single contact
		coil, rf:
L101	24-84972A15	8-1/2 turns; BRN
L102	24-84972A16	6-1/2 turns; RED
L103	24-84972A17	8-1/2 turns; ORG
L104	24-83857G07	12 turns; multiplier
L105	24-83857G05	14-1/4 turns; multiplier
L106, 107	24-83961B01	3 turns; BRN
L111	24-83961B01	3 turns; BRN
L207	24-82723H07	choke; 10 uH
L209	24-82723H05	choke; 0.41 uH; YEL
L301	24-82723H07	choke; 10 uH
L302 thru 304	24-84113B01	7-1/2 turns; BRN
L401	24-84258B05	GRN
L402	24-82723H07	choke; 10 uH
L501	24-83884G01	choke; molded
L502	24-83961B01	3 turns; BRN
L601	24-82549D25	choke; 10 uH
L602	24-84250D02	choke; 6.8 uH
L603	24-82723H07	choke; 10 uH
L604, 605	24-84250D02	choke; 6.8 uH
L606, 607	24-82723H07	choke, 10 uH
L608	24-84250D03	choke, 2.2 uH
L609	24-83879G04	20 turns; YEL
L701	24-83961B01	3 turns; BRN
		transistor: (see note)
Q101, 102	48-869658	NPN; M9658
Q401	48-869651	field-effect
		resistor, fixed: ± 10%; 1/4 W: unless otherwise stated
R101	6-124C55	1.8k
R102	6-124A69	6.8k ± 5%
R103	6-124A55	1.8k ± 5%
R104	6-124C83	27k
R105	6-124A13	33 ± 5%
R106	6-124C29	150
R107	6-124C81	22k
R108	6-124C61	3.3k
R109	6-124C55	1.8k
R110	6-124A09	22 ± 5%
R111	6-124C29	150
R112	6-124C01	10
R113	6-185B64	56; 1/8 W
R201, 202	6-124A39	390
R203, 204	6-124A93	68k
R205, 206	6-124A95	82k
R301	6-124A63	3.9k
R401	6-124C49	1k
R402	6-124A32	220 ± 5%
R403	6-124A81	22k ± 5%
R404	6-124C31	180
R501	6-124A63	3.9k ± 5%
R502	6-185B64	56; 1/8 W
R601	6-124A69	6.8k ± 5%
R605	6-124A75	12k ± 5%
R606	6-124A73	10k ± 5%
R607	6-124C05	15
R608	6-124A73	10k ± 5%
R613	6-124C01	10
R614	6-124A86	36k ± 5%
R615	6-124C53	1.5k
R616, 617	6-124A76	13k
R618	6-124C49	1k
R619	6-124A97	100k
R620	6-124A48	910 ± 5%
R621	6-124A33	220 ± 5%
R706	6-124C01	10
		integrated cicuit: (see note)
U601	51-84267A38	type M6738
U602	51-84267A07	type M6707
		crystal: (see note)
Y301	48-84577K01	45.0 MHz
Y601	48-84755E08	11.7 MHz
Y602 thru 604	48-84755E07	11.7 MHz
Y605	48-84754E01	11.7 MHz (discriminator)
		non-referenced items
	3-134212	SCREW; 4-40 x 5/16"; 10 req'd.
	3-138162	SCREW, tapping; 4-40 x 3/8"; 8 req'd.
	3-138891	SCREW, tapping; 6-32 x 7/16"; 6 req'd.
	4-49854	WASHER, spacer; 2 req'd.
	29-855943	PIN, terminal, plated; 20 req'd.
	29-10134A29	LUG, terminal
	29-84028H01	TERMINAL, male; 16 req'd.
	43-868700	BUSHING, threaded; 8 req'd.
	55-84300B02	HANDLE; 2.12"
	55-84300B03	HANDLE; 1.83"

TLN5891A Receiver Shield Kit PL-8217-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	3-135506	SCREW, tapping; 6-32 x 5/16"; 5 used
	26-82640L01	SHIELD

TRF6482A RF Deck PL-8216-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: ± 20%; 500 V: unless otherwise stated
C801	21-84547A01	1000-20%; 50 V
C802	21-84547A05	10000 pF
C803	21-84736E12	39 pF ± 5%; 500 V
C804	21-84873H17	56 pF ± 10%; 50 V
C805	21-84547A05	10000 pF
C806	21-84736E12	39 pF ± 5%; 500 V
		connector, receptacle:
J102	9-82547L02	female; single contact
		coil, rf:
L801 thru 807	1D83010K03	resonator and lead assy.
L808	76-83960B01	ferrite bead
L809	24-82723H05	choke; 0.41 uH
		connector, plug:
P301	28-84282D01	male; single-contact
P102	28-87317C01	male; single contact
		transistor: (see note)
Q801	48-869870	NPN; M9870
R801, 802, 803		cannot be replaced
		mechanical parts
	3-134268	SCREW, tapping; 4-40 x 7/16"; 4 req'd.
	15-84630E01	COVER, connector (J801)
	42-83032K01	HOLDER; 2 req'd
	64-83018K02	PLATE, cover
	29-5227	LUG, soldering; #6; 2 req'd.
	15-83014K01	HOUSING, rf deck
	2-84773E03	NUT, tension; 7 req'd.
	3-84997K01	SLUG TUNING; 7 req'd.
	32-82101L02	GASKET
	3-136138	SCREW, tapping; 6-32 x 3/8"; 11 req'd.
	32-82555M01	GASKET, lead

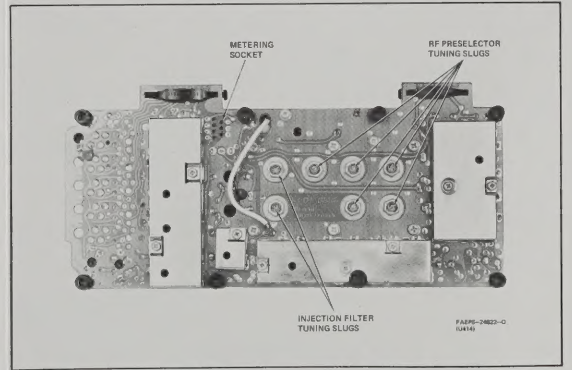
TRN6713A 2nd Oscillator Kit PL-4217-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: ± 5%: unless otherwise stated
C1	20-82399D04	variable; 5.5-18 pF
C2	21-82428B59	.01 uF + 80-20%; 200 V
C3	21-821474	470 pF ± 20%; 500 V
C4	21-82355B09	33 pF; 500 V
C5	21-831125	100 pF ± 10%; 300 V
C6	21-82187B14	.001 uF ± 10%; 100 V
C7	21-84395B01	40 pF; 500 V
C8	21-840848	6 pF ± 0.5 pF; 500 V
C9	21-82610C44	100 pF ± 10%; 100 V
C10	21-82880E33	80 pF; 600 V
C11	21-82187B14	.001 uF ± 10%; 100 V
C12	21-840848	6 pF ± 0.5 pF; 500 V
C13	21-82204B22	5 pF; 250 V
		coil, rf:
L1	24-82723H04	choke; 0.29 uH
L2	24-82723H05	choke; 0.41 uH
L3	24-890667	choke; 2.0 uH
L4	24-82723H01	choke; 1.2 uH
L5	24-82723H05	choke; 0.41 uH
		transistor: (see note)
Q1, 2	48-869494	NPN; type M9494
		resistor, fixed: ± 10%; 1/4 W: unless otherwise stated
R1, 2	6-124C77	15k
R3	6-124C51	1.2k
R4	6-124C77	15k
R5	6-124A37	330 ± 5%
R6	6-124A53	1.5k ± 5%
		crystal:
Y1	48-83860F09	33.3 MHz
		mechanical parts
	3-139012	SCREW, 4-40 x 1/4"
	4-474216	WASHER, 2 req'd.
	15-82304L01	COVER
	43-83066F05	BUSHING, 0.250" length; 2 req'd.
	43-83066F06	BUSHING, 0.170" length
	43-83617D01	BUSHING, round
	14-84602K02	INSULATOR, crystal; 2 req'd.
	26-82303L01	SHIELD
	43-82555L01	SPACER, threaded (oscillator shield)

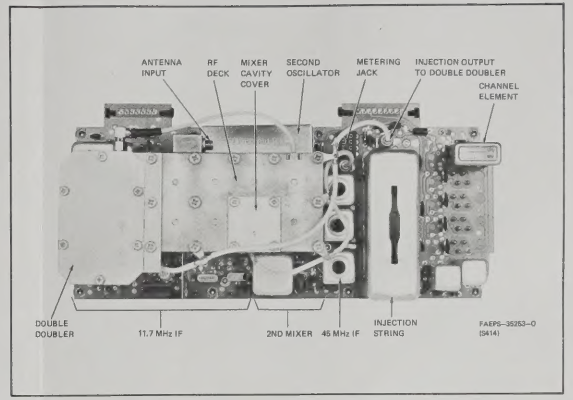
TLF6492A Double Doubler Board (Rcvr.) PL-8244-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: pF; 50 V: unless otherwise stated
C201	21-84736E08	16 ± 5%
C202	21-84736E18	5.6 ± 0.5 pF
C203	21-84736E18	5.6 ± 0.25 pF
C204	21-84547A05	.01 uF ± 20%
C205	21-84736E12	39 ± 5%
C206	21-84736E31	58 ± 10%
C207	21-84736E17	6.8 ± 0.5 pF
C210	21-84736E29	7.5 ± 0.25 pF
C211	21-84736E21	100 ± 5%
C212	21-84736E12	39 ± 5%
C220	91-87511C01	RFI; 1750
		connector, receptacle:
J103	9-87318C04	female, panel mounting
		coil, rf:
L201	24-84311M22	2-turns
L202	24-84311M39	5-turns
L203	24-84331M44	3-turns
L204	24-82723H40	290 nH
L205, 206	24-84331M10	4-turns
L210	24-84331M44	3-turns
L211	24-84331M47	7-turns
L212	24-84331M22	2-turns
L213	24-84331M45	4-turns
		connector, plug:
P102	28-84282D01	phono, male
		transistor: (see note)
Q201	48-84411L73	NPN; M1173
Q202	48-84411L74	NPN; type M1174
		resistor, fixed: ± 5%; 1/8 W:
R201	6-185B84	2.7 kohms ± 10%
R210	6-185A77	15k
R211	6-185A49	560
R212	6-185A23	82
R220	6-185A25	100
		cable assembly:
W1	1-80791B63	consists of: ref. item P102
	30-83794C01	CABLE, coaxial; 11" used
	29-5227	LUG, solder; 2 used
W201	1-80764D86	consists of: ref. item J103
	30-859004	CABLE, coaxial; 3.5" used
		mechanical parts
	29-83208M01	LUG, solder
	3-134169	SCREW, tapping; 4-40 x 1/4"; 6 used
	15-82575L01	HOUSING, quadrupler
	30-10151A17	WIRE, flat
	64-82576L01	PLATE, cover
	39-10184A34	CONTACT, receptacle

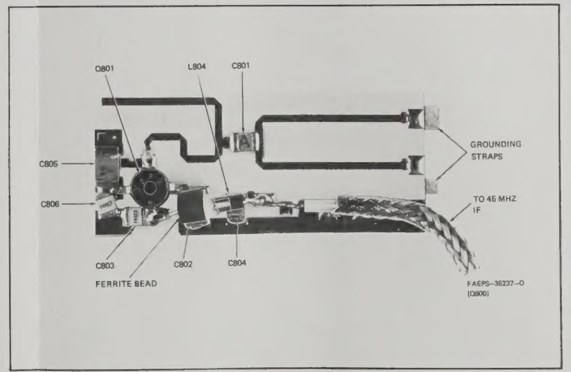
note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.



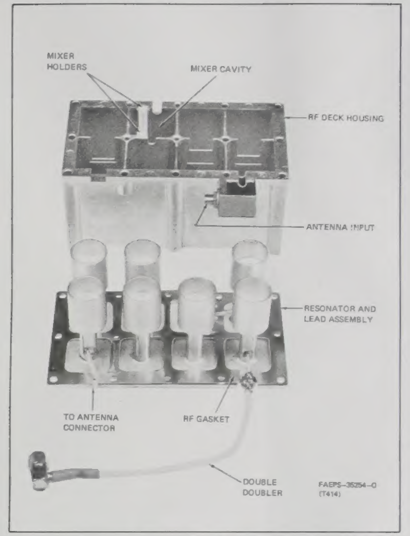
RECEIVER REAR VIEW



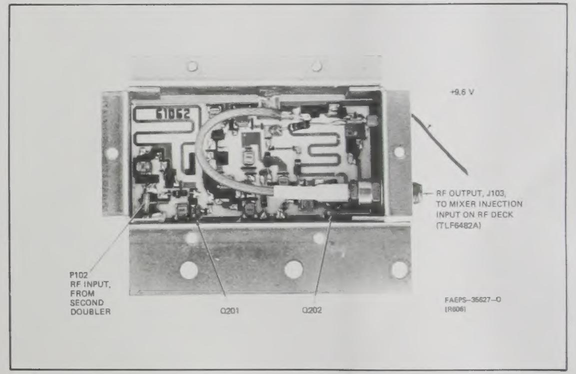
RECEIVER FRONT VIEW



MIXER BOARD



RF DECK



DOUBLE DOUBLER

RECEIVER ALIGNMENT PROCEDURE

A. FREQUENCY CALCULATIONS

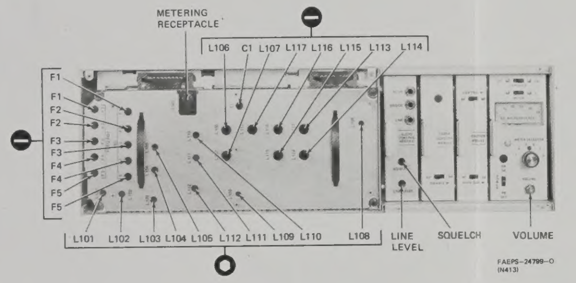
Where:

f_o = channel element frequency

f_c = carrier frequency

$$f_o = \frac{f_c - 45\ \text{MHz}}{48}$$

B. RECEIVER ADJUSTMENT LOCATIONS



C. MINIMUM RECEIVER METER READINGS
(NO INPUT SIGNAL APPLIED)

Test Set Selector Switch Position	Reading (uA)	Circuit Metered
1	10	Channel Element Output
2	15	First Doubler Output
3	10	Second Doubler Output
4+, 4-	0 ±2	Discriminator Output
5	10	Second I-F Amplifier and Limiter

D. RECEIVER ALIGNMENT

Step	Adjust	Meter Position	Stage and Procedure
1	L101, L102, L103, L104, L105		MULTIPLIER COILS — Adjust the cores of L101, L102, L103, and L105 to the end of the coil form flush with the printed circuit board. Adjust the core of L104 fully clockwise to the end of the coil form away from the printed circuit board.
2	L110, L111, L112		FIRST I-F COILS — Adjust the cores of L110, L111, and L112 to the end of the coil form flush with the printed circuit board.
3	L106, L107, L113, L114, L115, L116, L117		PRESELECTOR AND INJECTION FILTER — Adjust the slugs at L106, L107, and L113 through L117 away from the rf deck until they stop. Adjust L106 four turns clockwise and L117 two turns clockwise.
4	L101, L102	1	CHANNEL ELEMENT OUTPUT — Adjust L102 two turns clockwise. Alternately turn L101 and L102 clockwise 1/2 turn at a time until a peak indication is achieved on meter 1.
5	L103, L104	2	FIRST DOUBLER — Tune L103 clockwise for a peak reading on meter 2. Tune L104 counterclockwise until meter 2 dips.
6	L104, L105	3	DOUBLE DOUBLER — Tune L105 clockwise until a peak reading is achieved on meter 3. Tune L104 counterclockwise until a peak reading is achieved on meter 3. Repeak L104 and L105 until no further improvement is obtained.
7	L108	4, 5	DISCRIMINATOR — Insert the center conductor of the output cable from a 11.7 MHz test oscillator into the L109 hole on the receiver shield. Do not contact the circuit board. Insert the conductor far enough to obtain a saturated reading on meter 5. M5 saturates at about 40 uA. By tuning L108, it should then be possible to obtain readings on either side of zero (center) on meter 4. Tune L108 for an EXACT zero (center) reading. *This adjustment is critical.*
8	C1	4, 5	SECOND OSCILLATOR WARP CAPACITOR — Insert the 45 MHz injection probe into the L112 hole in the receiver shield. Tune C1 until quieting is obtained and meter 5 increases. Tune C1 for an EXACT zero reading on meter 4. *This adjustment is critical.*
9	L106	4, 5	INJECTION FILTER — Unsquelch the receiver and connect an rf signal generator to the antenna connector. Set the rf output level of the generator to maximum and set the generator to the carrier frequency (M4 equals exactly 0 uA). Tune L106 for a peak reading on meter 5, reducing the generator level as necessary to keep meter 5 out of saturation (between 30-40 uA).
10	L107, L105, L104	3, 5	Detune L101 until meter 3 drops to 10 uA. Tune L107 for a peak reading on meter 5, reducing generator output as necessary to keep meter 5 between 30 and 40 uA. Repeak L101 and L102 for best peak on M1.
11	L113, L114, L115, L116, L117	5	RF PRESELECTOR — Tune L117, L116, L113, L114 and L115 in that order for a peak reading on meter 5. Reduce the generator level as necessary to keep meter 5 out of saturation, between 30 and 40 uA.
12	F1	4	Adjust F1 channel element. Inject a known, accurate carrier frequency into the receiver. Adjust the channel element warp capacitor for a zero reading on meter position 4.
13	L110, L111, L112, L109	5	FM modulate the carrier frequency with a 1 kHz tone at 7.5 kHz deviation. Peak L110, L111, L112, and L109 in that order for a maximum reading on meter 5.
14	L113, L114, L115, L116, L117	5	Tune L113, L114, L115, L116, L117 in that order for best noise quieting.
15	—	—	Perform 20 dB quieting sensitivity measurements to check alignment. If delay line option C770 is used in your station, move jumpers on the *PURC* control board as follows: JU2401D OUT, JU2401E IN, and JU240 I-F OUT. After performing the 20 dB quieting measurement return these jumpers to their original positions.

MODEL TABLE

Model	Model Breakdown	Description
TRF1032A	TRF1181A TRF6112A TRN6713A	RF Injection Deck Receiver RF & I-F Board Second Oscillator
TRF1181A	TLF6482A TLF6492A	RF Deck Double Doubler

TECHNICAL CHARACTERISTICS

RF Frequency Range	928-960 MHz
Channel Spacing	25 kHz
EIA Modulation Acceptance	±8 kHz minimum
Frequency	Channel element maintains receiver frequency within ±0.0002% of reference frequency from -30°C to +60°C ambient temperature (+25°C reference).
Input Impedance	50 ohms
Sensitivity; 20 dB Quieting	0.5 uV
Selectivity (EIA Sinad)	-80 dB @ ±25 kHz
EIA Sinad Intermodulation	-75 dB
Spurious and Image Rejection	100 dB minimum
Squelch Sensitivity Carrier Squelch (adjustable)	0.25 uV or less at threshold
Tone-Coded Squelch	0.25 uV or less
Digital-Coded Squelch	0.25 uV or less